Using Compost to Control Construction Site Runoff and Erosion

Construction site erosion = $$$$

Few land uses are more prone to damage from storm water runoff and erosion than construction sites. The soil compaction, destruction of ground cover, and topsoil stripping associated with construction projects can dramatically increase runoff and, according to the USEPA, boost soil loss rates to at least 20 times those resulting from other types of land use (USEPA, 2002).

For land developers and construction site managers, failure to control storm water runoff and erosion can be costly. Hillsides scarred by excessive erosion will require topsoil replacement, re-grading, and reseeding. And, culverts, storm drains, and curb areas that are clogged with eroded soil, or undercut by storm water, must be cleaned or repaired.

The off-site effects of uncontrolled storm water and erosion are equally important. Sediment and chemical pollutants flushed into streams from unprotected construction areas can bury valuable fish habitat, stimulate excessive aquatic plant growth, diminish recreational opportunities, and increase water treatment costs.

Unprotected soils on sloping construction sites like this can experience rapid and costly soil erosion.

New storm water regulations for Iowa construction sites

The National Pollutant Discharge Elimination System Phase II requirements took effect on March 10, 2003, meaning all construction sites in Iowa at which one acre or more of soil is disturbed are required to obtain storm water permit coverage.

Iowa uses a general permit for construction sites. Each construction site authorized under this general permit requires a pollution prevention plan (PPP) be written prior to applying for the permit. The PPP must address the manner in which erosion at the site will be controlled. This must include both the types and placement of erosion controls used. This requires that considerable thought be given to erosion control practices prior to both permit application and actual construction.

For more information on obtaining a storm water permit, please visit www.iowadnr.com and click on "Water Quality," or call 515-281-7017.

Controlling runoff & erosion

Stop erosion before it starts

Once runoff and erosion starts, the problem intensifies quickly so it's important to stop erosion before it starts. Many best management practices exist for controlling runoff and erosion including, but not limited to, check dams, silt fence, filter berms, riprap, seeding, mulching, grass-lined channels, vegetated buffers, compost blankets, and inlet protection.

The most effective control measures are those that prevent runoff and erosion by:

- increasing the soil's ability to absorb water
- reducing exposure of bare soil to raindrop impact
- preventing concentration of flowing water into rills and small gullys

Traditionally, one of the most effective ways to achieve these goals has been through planting and maintenance of grasses and similar vegetation that shield the soil from raindrop impact and that diffuse or slow runoff before it becomes concentrated in rills and gullys.

Unfortunately, establishing vigorously growing vegetation on construction sites is not always easy. Temporary or permanent topsoil stripping, for example, may leave compacted or poor quality soils that do not support vigorous plant growth. Even relatively brief periods of wet or dry weather can hinder seeding efforts and stifle emergence and growth of young plants. And construction sites that are cleared at the end of the growing season must face snow melt and early spring rains without the benefit of vegetative cover. Use of compost has proven to be an effective way to overcome many of these difficult site problems.

Why use compost?

It works

Compost is a product resulting from controlled and accelerated biological decomposition of valuable organic by-products, such as yard trimmings, sewage sludge (biosolids), animal manure or food processing residuals. The composting process produces heat that kills pathogens and weed seeds. Some composts have a distinctly mulch-like texture, while others are much more soil-like. Composts tend to have a coarser texture, produce less runoff and are more resistant to erosion than soil.

Composts are an excellent source of soil-building organic matter that helps to absorb and store moisture and provide a favorable environment for root growth. Although composts are not typically considered to be fertilizers, those produced from animal manure, bio-solids, or other inputs having significant

nutrient content can be used as a slow-release source of plant-available micro- and macronutrients.

Compost has long been recognized as a valuable amendment that improves the physical, chemical, and biological characteristics of soils. Because of these useful characteristics, composted organics are often used to improve vegetative growth on construction sites that lack good quality soil.

In addition to its potential to improve soil quality, a recent (2000 – 2002) Iowa State University study sponsored by the Iowa Department of Natural Resources and the Iowa Department of Transportation showed that, when exposed to high intensity (4 inches/hour) rainfall lasting 30 minutes or more, 2- to 4-inch thick blankets of compost provided the following benefits on 3:1 construction site slopes:

- Due to the relatively coarse texture and high infiltration capacity of most composts, runoff from compost-treated roadway embankments was significantly delayed and totaled only about one-fifth as much as that from unprotected roadway embankment areas.
- Low runoff rates and raindrop shielding provided by compost blankets resulted in erosion rates less than 1% of those on unprotected roadway embankment areas.
- Seasonal weed growth on compost-treated areas was only about one-fourth of that on untreated embankment areas.

It's the law

Chapter 455D.9(4) of the Code of Iowa states "State and local agencies responsible for the maintenance of public lands in the state shall give preference to the use of composted materials in all land maintenance activities." Code of Iowa chapter 314.12A, "Preservation of Topsoil in Highway Construction," promotes the use of compost to provide vegetative cover to prevent erosion.

Recommendations for using compost

Compost blankets

Compost blankets consist of a layer of compost placed on the sloped areas of construction sites to help prevent initiation of runoff and erosion. These compost blankets are applied at a depth of ½ inch to as much as four inches depending on where and why the compost is being used. Guidelines recently adopted by the American Association of State Highway and Transportation Officials (AASHTO) indicate that in Iowa, most compost blanket applications will perform best when applied at a depth of ¾-1" on surfaces to be vegetated and 1½" - 2" inches for surfaces that will not be vegetated. The erosion and runoff study by Iowa State University showed relatively little difference in performance between 2-inch and 4-inch blanket applications on 3:1 slopes. To avoid bare spots caused by applicator variability and localized traffic patterns, however, a minimum application depth of two inches is recommended.

Tests conducted on 3 to 1 slopes using simulated rainfall rates of up to 4 inches/hour revealed little, if any, tendency for compost blankets to be "flushed" downhill during intense rainstorms. As a result, there appears to be no need to incorporate compost into the underlying soil to prevent downhill movement during storm events. Disking or harrowing of the slope (parallel to the contour lines) prior to compost application, however, is recommended to provide a roughened bonding surface between the compost and the underlying soil.

Compost blanket used on detention pond slopes.

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Sites and conditions

Compost is most effective in situations where immediate runoff and erosion control are needed including situations such as:

- Projects begun too late in the growing season to establish erosion control vegetation
- Projects begun during abnormally wet or dry weather that delays the emergence and growth of vegetation
- Areas with poor quality (low organic matter) soils that do not support vigorous growth of vegetation
- Steep and/or wet locations that are difficult to reach or negotiate with conventional tilling, seeding, or mowing equipment, but that can be blanketed with low-density compost applied with a compost blower truck.

Situations where special considerations should be taken

Compost blanket applications are not designed to carry concentrated runoff or for use in locations that receive direct discharge of concentrated water flow (point discharges) from adjoining areas. Compost blankets installed on roadway for slopes that may receive concentrated runoff from traffic lanes, for example, should be protected with compost berms, silt fences, hay bales, or similar measures that slow down or divert concentrated flow away from the blankets, or that spread or diffuse the flow before it flows onto the blankets. Compost filter berms or compost socks may be appropriate for areas receiving concentrated runoff if installed properly.

Blanket applications or incorporated?

On relatively flat sites where compost is used primarily to improve soil quality, compost treatments have traditionally been incorporated into the underlying soil with a disk or tractor-powered tiller. Incorporation helps to break up the dense underlying soil compacted during construction, providing a deeper rooting zone for newly seeded vegetation, and helping to avoid a two-layer soil system that can lead to shallow rooting and poor growth.

On sloping construction sites where immediate runoff and erosion control are the main goals, blanket compost applications are recommended. Because composts are less dense and more porous than natural soils, they have an "open" structure that absorbs and holds water better than most natural soils. If the underlying soil is relatively fine textured, tilling or disking will mix fine particles into the compost matrix, reducing the compost's water storing capacity (increasing runoff), and exposing small highly-erodible soil particles to the erosive force of direct rainfall impact.

Blanket applications are also recommended to help control weed growth. Since composting processes typically produce temperature conditions sufficient to kill weed seeds, most good quality composts contain few viable weed seeds. Incorporating the compost into the underlying soil, however, can bring dormant weed seeds from the soil up into the compost, thereby negating the weed barrier effect provided by blanket compost applications.

Application Methods & Depth

Compost can be applied like topsoil with a front-end loader, with broadcast spreaders, or with blower trucks. Broadcast spreaders can generally apply material more quickly than blowers. Blower trucks, however, are particularly useful for applying compost to areas that are difficult or unsafe to negotiate with heavy equipment.

Compost Berms and Socks

In addition to the compost blankets discussed above, compost-filled socks and berms constructed of compost may also be a wise choice to control runoff and erosion. "Socks" filled with a larger particle size compost have been used as a replacement to traditional silt fence and ditch check products.

Compost filter berms and socks are easy to install require less maintenance than traditional silt fences and can be seeded over and left in place or the product can be spread on site.

A compost berm.

Guidelines recently adopted by AASHTO indicate that in Iowa, compost filter berms will perform most effectively when constructed 1' high x 2' wide or 11/2' high by 3' wide.

Compost sock used for inlet protection.

AASHTO recently adopted the following test and particle size parameters for compost products for controlling erosion. See Table 1 for recommendations on selecting the best compost for use in filter berms and socks.

Where to obtain Iowa compost products

Iowa's composting industry has grown from just a few facilities to an industry that processes nearly 400,000 tons of organic wastes annually. To find a compost producer in your area and information on Iowa companies with specialized compost application equipment, please visit the Iowa Department of Natural Resources' Web page at www.mulchiowa.com.

Selecting a quality compost product?

When using compost to control runoff and erosion, contractors should exercise care in choosing a quality product. Product quality is extremely critical on areas where vegetation will be established. Contractors and landscape architects should request compost test results from their compost supplier. Several Iowa compost producers participate in the United States Composting Council's Seal of Testing Assurance. The Seal of Testing Assurance Program is a compost testing and information disclosure program which uses uniform testing and sampling protocols, and requires the disclosure of test analyses and product ingredient data, as well as end use instructions to compost customers. Refer to Table 1 on the next page to select the appropriate compost for your needs.

Table 1 – Compost Blanket & Filter Berm Parameters

Parameters[1,4]	Reported as (units of measure)	Surface Mulch to be Vegetated	Surface Mulch to be left Un-vegetated	Filter Berm to be Vegetated	Filter Berm to be left Un-vegetated
pH[2]	pH units	5.0 - 8.5	N/A	5.0 - 8.5	N/A
Soluble Salt Concentration[2] (electrical conductivity)	dS/m (mmhos/cm)	Maximum 5	Maximum 5	Maximum 5	N/A
Moisture Content	%, wet weight basis	30 – 60	30 – 60	30 – 60	30 – 60
Organic Matter Content	%, dry weight basis	25 – 65	25-100	25 – 65	25 - 100
Particle Size	% passing a selected mesh size, dry weight basis	3" (75 mm), 100% passing 1" (25mm), 90% to 100% passing 3/4" (19mm), 65% to 100%passing 1/4" (6.4 mm), 0% to 75% passing Maximum particle length of 6" (152mm)	3" (75 mm), 100% passing 1" (25mm), 90% to 100% passing 3/4" (19mm), 65% to 100%passing 1/4" (6.4 mm), 0% to 75% passing Maximum particle length of 6" (152mm)	3" (75 mm), 100% passing 1" (25mm), 90% to 100% passing 3/4" (19mm), 70% to 100% passing 1/4" (6.4mm), 30% to 75% passing Maximum: particle size length of 6" (152mm) (no more than 60% passing 1/4" (6.4 mm) in high rainfall/flow rate situations)	3" (75 mm), 100% passing 1" (25mm), 90% to 100% passing 3/4" (19mm), 70% to 100% passing 1/4" (6.4mm), 30% to 75% passing Maximum: particle size length of 6" (152mm) (no more than 50% passing 1/4" (6.4 mm) in high rainfall/flow rate situations)
Stability[3] Carbon Dioxide Evolution Rate	mg CO_2-C per g OM per day	< 8	N/A	< 8	N/A
Physical Contaminants (man-made inerts)	%, dry weight basis	< 1	< 1	< 1	< 1

[1] Recommended test methodologies are provided in Test Methods for the Examination of Composting and Compost (TMECC, The US Composting Council)
[2] Each specific plant species requires a specific pH range. Each plant also has a salinity tolerance rating, and maximum tolerable quantities are known. When specifying the establishment of any plant or turf species, it is important to understand their pH and soluble salt requirements, and how they relate to the compost in use.
[3] Stability/Maturity rating is an area of compost science that is still evolving, and as such, other various test methods could be considered. Also, never base compost quality conclusions on the result of a single stability/maturity test.
[4] Landscape architects and project (field) engineers may modify the allowable compost specification ranges based on specific field conditions and plant requirements.

Cost of purchasing compost

Compost is cost competitive with other traditional runoff and erosion control methods while providing improved soil quality. The cost of compost varies depending on the quantity, quality and location of the product. When purchasing compost products for runoff and erosion control applications keep in mind the AASHTO specifications above.

Other Useful References

For further information about the study on which this bulletin is based, please access the project web site, "*Using Compost for a Safer Environment"* which can be found at: **http://www.eng.iastate.edu/compost/**

Additional information regarding the USEPA Phase 2 stormwater control requirements for construction sites can be found at:
http://cfpub.epa.gov/npdes/stormwater/const.cfm.

The U.S. Environmental Protection Agency has produced a series of fact sheets to assist contractors and local governments in compliance with NPDES Phase II requirements. The fact sheets are available at http://www.cfpub.epa.gov/npdes/stormwater/meunofbmps/menu.cfm

To learn more about compost production and use in Iowa, visit the Iowa Department of Natural Resources Recycling and Composting program website at: www.iowadnr.com and click on "waste management."

The United States Composting Council has additional information on using compost on construction sites including landscape architect specifications at:
http://www.compostingcouncil.org

Written by Dr. Tom Glanville, Dr. Tom Richard, & Mr. Russell Persyn, Iowa State University Department of Agricultural & Biosystems Engineering; and Iowa Department of Natural Resources staff